Hybrid Automata Model Approach for Coordinating Traffic Signal Control

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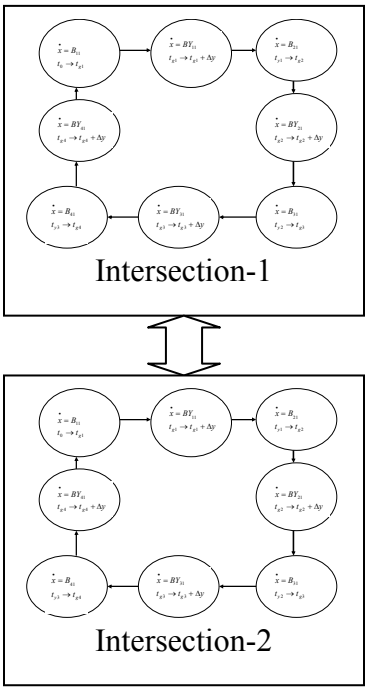
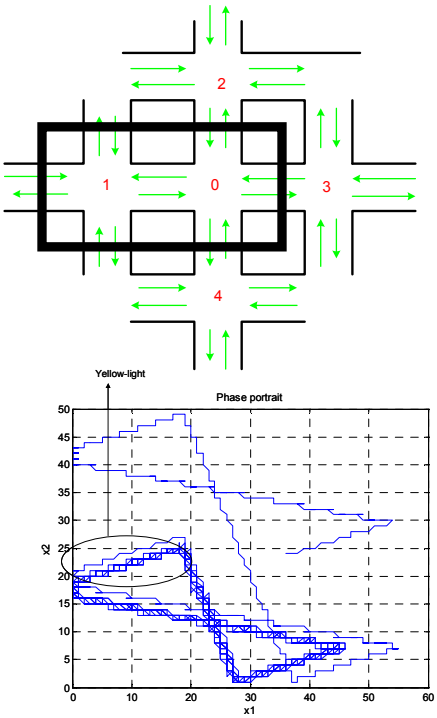
Abstracts

This paper studies the control of urban road traffic. A network of roads with signalized intersections is considered. Coordinating control for traffic control based on hybrid automata is investigated. The coordination has hierarchical properties where low-level control action is described via the red/green switching-time and high-level action is adjusting the cycle time and the average offset, in between successive traffic light.

Composition of fluid-flow based hybrid automata model per intersection (a switched linear system) and a simple delay model for the connecting links is used with red-yellow-green signal transition times as control values. A traffic signal controller is designed to minimize the average delay using information on the flow of vehicles from the adjacent intersections. This information is important to determine the switching time of the traffic light of the next period and also to change the offset for coordinating.

At this time we concentrate the analysis of two intersections to develop a low-level controller but already using minimum information from the adjacent intersections. Currently we consider threshold based controllers that switch from green to red for direction 1 when the queue-length for direction 2 hit the threshold or when the queue length for direction 1 becomes 0. In the future, coordination and high-level model will be explored more rigorously.





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